

A note on the use of preferences

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breviated to give only the gender and position in the tables). The election stages were as follows:

1 Introduction

With STV, the voter is encouraged to specify as many preferences as may be needed to reflect his/her wishes. The number of preferences actually used within the count is quite a different matter which is the main subject of this note.

For the three Irish constituencies for which a trial was undertaken in 2002 of electronic voting, we have full disclosure of the preferences specified by the voters. This provides an opportunity to analyse the use of preferences in a large public election in some depth.

Joe Otten has stated reservations about the full disclosure of preferential voting data on the grounds that it could allow bribery to take place even though the voting is secret [1]. The issue has also been raised by the Irish Commission on Electronic Voting [3].

Here, we consider how the voter's preferences are used and propose alternative solutions to the problem of disclosure.

2 The use of the voter's preferences

It is clear that any preference listed after a continuing candidate cannot be used at that stage of the count. To inspect such a preference would contravene one of the principles of STV. A particular example of this is that those voters who gave their first preference for a candidate who is still a continuing candidate at the end of the count, will not have anything other than their first preference used.

As an example of how preferences are used, consider the 2002 Dáil election for the Meath constituency for which we have full election data. There were 14 candidates for 5 seats (the candidate names have been ab-

Stage 1	Elect M4
Stage 2	Exclude F3 and M11
Stage 3	Exclude M9
Stage 4	Exclude M8
Stage 5	Exclude M10
Stage 6	Exclude M14
Stage 7	Exclude M6
Stage 8	Exclude M7, Elect M2
Stage 9	Elect M1, M5 and F13

Hence the continuing candidate is M12.

Now consider an actual voter whose preferences were as follows:

M9 M8 M7 M10 M12 M11 M14 F3 F13 M1 M4 M2 M6 M5

Consulting the actions of the stages above, it is clear that the preferences for M10 and all those after M12 were never used. In other words, the voter could just as well have voted: M9, M8, M7, M12. The other preferences were *invisible*.

To understand the use of the preferences in more detail, we look at the result sheet in Table 5.1. At the second stage, the surplus of M4 is transferred. To do this, all of the 11,534 votes for M4 are inspected and the number whose second preference is given is found, together with the proportion for each of the remaining 13 candidates. Since 853 votes must be transferred to reduce M4 to the quota, an integer is computed for each candidate giving the correct proportion and total. As an example of a transfer, only one vote is transferred to M11 and that vote is selected at random from those giving M11 as the second preference. This implies that 10,681 votes are inspected for their subsequent preference and a further 853 votes are used in the subsequent stages.

Hence we have two uses of preferences with the Irish rules: those used directly to attempt to elect a candidate and those used indirectly to determine which papers to select at random to transfer. For the Meath election, the number of preferences used directly are those for the first preference (the total vote of 64,081) plus the number of those in the table with a + sign but ignoring those in the non-transferable row. The indirect use, which only arises from a transfer of surplus is therefore only from M4, i.e. the 10,681 mentioned above.

In contrast to this, the Meek method uses all the visible preferences. Our sample ballot paper above had four visible preferences M9, M8, M7 and finally M12. In fact, the Irish rules would use all these preferences.

We can now compute the use of the preferences for the three Irish constituencies, expressed as an average per vote:

Constituency	Irish-direct	Indirect	Meek	All
Meath	1.19	0.17	1.98	4.65
Dublin North	1.33	0.01	2.12	4.98
Dublin West	1.26	0.25	2.11	4.43
<i>Average of 3</i>	1.26	0.14	2.07	4.68

Hence, as a percentage of all the preferences given, the direct use with the Irish rules is 27%, indirect usage is 3%, while Meek uses 44%.

3 Full disclosure?

We can now see that relatively few preferences are actually used in a count. If the voter specifies a large number of preferences, then it is unusual for them all to be used. For an example of a large number of preferences which were used, see [2].

We now have a means of providing an approximation to full disclosure which would nevertheless allow the voter to check the actual count: remove some (or all) of the invisible preferences. For long preference lists, like the one shown above, it would usually be the case that many preferences would be invisible. Hence this strategy of providing full disclosure only of the visible preferences would effectively prohibit the potential problem identified by Joe Otten.

Note that the identification of the invisible preferences depends upon the order of the exclusions and elections which in turn depends upon the particular counting rules being used. Hence, if data were provided with only the visible preferences, then running

that data using a different counting rule would not necessarily give the same result as using the actual data.

4 Conclusions

Since many preferences are not used in a count, it is possible to disclose all the used preferences and remove all or part of the unused preferences to avoid any potential breach of confidentiality. The referee made two additional points: it is possible to *add* invisible preferences as well as removing them; and that *any* change to the data implies that a check is not an exact check.

5 References

- [1] J Otten. Fuller Disclosure than Intended. *Voting matters*. Issue 17. p 8. 2003.
- [2] I D Hill. What would a different method have done? *Voting matters*. Issue 16. p 5. 2003.
- [3] Interim Report of the Commission on Electronic Voting on the Secrecy, Accuracy and Testing of the chosen Electronic Voting System. http://www.cev.ie/htm/report/download_report.htm

		Surplus M4	Exclude F3+M11	Exclude M9	Exclude M8	Exclude M10	Exclude M14	Exclude M6	Exclude M7
<i>M1</i>	8493	+258 8751	+36 8787	+46 8833	+46 8879	+108 8987	+123 9110	+467 9577	+299 9876
<i>M2</i>	7617	+76 7693	+32 7725	+155 7880	+241 8121	+333 8454	+694 9148	+1733 10881	10881
F3	263	+2 265	-265 —	—	—	—	—	—	—
<i>M4</i>	11534	-853 10681	10681	10681	10681	10681	10681	10681	10681
<i>M5</i>	5958	+61 6019	+52 6071	+68 6139	+126 6265	+374 6639	+737 7376	+1349 8725	+1429 10154
M6	3877	+15 3892	+11 3903	+34 3937	+41 3978	+74 4052	+221 4273	-4273 —	—
M7	3722	+29 3751	+56 3807	+113 3920	+185 4105	+359 4464	+675 5139	+119 5258	-5258 —
M8	1373	+7 1380	+23 1403	+163 1566	-1566 —	—	—	—	—
M9	1199	+3 1202	+42 1244	-1244 —	—	—	—	—	—
M10	2337	+16 2353	+53 2406	+224 2630	+200 2830	-2830 —	—	—	—
M11	180	+1 181	-181 —	—	—	—	—	—	—
M12	6042	+51 6093	+51 6144	+123 6267	+118 6385	+325 6710	+412 7122	+226 7348	+732 8080
<i>F13</i>	8759	+313 9072	+32 9104	+180 9284	+361 9645	+362 10007	+254 10261	+113 10374	+1261 11635
M14	2727	+21 2748	+21 2769	+75 2844	+120 2964	+631 3595	-3595 —	—	—
Non-T	—	—	+37 37	+63 100	+128 228	+264 492	+479 971	+266 1237	+1537 2774
Totals	64081	64081	64081	64081	64081	64081	64081	64081	64081

Table 5.1: Meath, 2002: Quota: 10681. Those elected have their names in italics.